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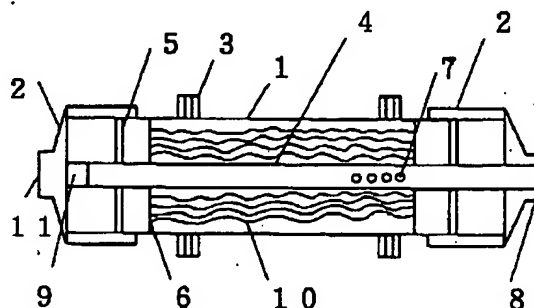
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(54) 【発明の名称】 中空糸膜モジュール

(57) 【要約】

【構成】 中空糸膜束が外筒の中に収納され、接着剤で中空糸膜束の少なくとも一端を気密に接着してなる中空糸膜モジュールであって、モジュール内の中空糸膜が固定されている端部表面は、(A) 固定されている中空糸膜が密に分布している表面、(B) 固定されている中空糸膜が実質上分布していない表面、を有し、かつ、表面(A)は表面(B)により、複数に分けられていることを特徴とする中空糸膜モジュール。

【効果】 エアースクラビングによる目詰まり除去効果が大幅に改善された中空糸膜モジュールが提供される。



## 【特許請求の範囲】

【請求項 1】 中空糸膜束が外筒の中に収納され、接着剤で中空糸膜束の少なくとも一端を気密に接着してなる中空糸膜モジュールであって、モジュール内の中空糸膜が固定されている端部表面は、(A) 固定されている中空糸膜が密に分布している表面、(B) 固定されている中空糸膜が実質上分布していない表面、を有し、かつ、表面(A) は表面(B) により、複数に分けられていることを特徴とする中空糸膜モジュール。

【請求項 2】 請求項 1 の表面(B) の幅が、3mm以上であることを特徴とする請求項 1 記載の中空糸膜モジュール。

【請求項 3】 接着剤固化部内部に、中空糸膜束を保持するための整束板を用いることにより、請求項 1 記載の表面(A) および表面(B) を形成することを特徴とする請求項 1 記載の中空糸膜モジュール。

【請求項 4】 請求項 3 記載の整束板が接着剤固化部内部に埋没していることを特徴とする請求項 3 記載の中空糸膜モジュール。

【請求項 5】 整束板上に中空糸膜を貫通保持するための空間のほかに、接着剤および空気の流通を促進するための貫通孔を設けたことを特徴とする請求項 3 に記載の中空糸膜モジュール。

【請求項 6】 中空糸膜束が複数の束に分割され、かつ分割された中空糸膜束がパイプのまわりに配列されていることを特徴とする請求項 1 に記載の中空糸膜モジュール。

【請求項 7】 中空糸膜モジュールを構成する中空糸膜が、アクリロニトリルを少なくとも 1 成分とする重合体からなることを特徴とする請求項 1 に記載の中空糸膜モジュール。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】 本発明は、液体のろ過操作を行なうための中空糸膜モジュールに関する。

## 【0002】

【従来の技術】 一般の工業用水には、多くの SS 成分、微粒子、ゴミ、細菌類、藻類、などが含まれており、このまま使用されると、用水配管の詰まり、細菌の増殖、ライン中のスケール堆積などのトラブルを生じる原因となりやすい。従来、これらの水中混入成分を除去するために、砂ろ過、凝集ろ過、凝集沈殿ろ過、カートリッジろ過などの各種方法が用途に応じて使用されてきた。これらの一般ろ過法に変わる新規な手法として、最近では多孔質の中空糸膜によるろ過が実用化され始めつつある。中空糸膜による水処理、ろ過は、近年急速に普及し、その適用分野も年々広くなりつつある。

【0003】 中空糸膜のろ過において、中空糸膜は何千〜何万本を束に束ねた後に端部を接着剤で固定した形状の商品形態に加工される。そして、これらの商品形態に

加工されたものは、中空糸膜モジュールと呼ばれている。液体のろ過が可能な中空糸膜モジュールとしては従来から多くの形態のものが提案されている。特に初期のものとしては、適度な前処理手段と組み合わせて使用されるろ過モジュール、逆浸透ろ過を目的としたもの、透析用途を目的としたものなどがあり、これらの用途を主目的として、多くのモジュール形態が提案されており、その主なものを挙げると、特公昭 48-28380 号公報、特開昭 49-69550 号公報、特開昭 53-100176 号公報、などに記載されているものがある。これらは、全て、液体のろ過を実施するにあたり、使い捨て、あるいは、汚れが一定量以上付着した段階において、清澄水または薬液水による洗浄やフラッシング処理を実施するのが普通であった。これに対して、最近では、中空糸膜モジュール形状に工夫をこらし、エアにより中空糸膜の性能回復を実施する方法が試みられている。特開昭 61-263605 号公報は、中空糸膜を U 字型に組み込み、容器に収納して使用するものであり、定期的に容器の下部に設けられたエア導入口からエアを導入させてエアスクラビングにより中空糸膜を振動させ、膜面の堆積物の除去を試みるものである。また、特開昭 60-206415 号公報は、中空糸膜を中心パイプの回りに配列させた両端固定型モジュールであり、前記同様に容器に組み込み、エアスクラビングにより中空糸膜膜面の堆積物を除去するものである。これらの技術は、既に実用化の検討が開始されている。

## 【0004】

【発明が解決しようとする課題】 中空糸膜モジュールの製造方法において、中空糸膜を中心パイプの回りに配列させる試みは一般によく用いられるが、現状のモジュールにおいては、下記の課題が残されている。すなわち、中空糸膜を何千〜何万本もを中心パイプの回りに均等に配列するのは難しく、中空糸膜を中心パイプのまわりに配列、仮止めした状態で両端を接着剤により封止した場合、接着剤の硬化時間中に中空糸膜束が重力により下方に落下し、中空糸膜を均等に配列された中空糸膜モジュールを得ることが難しい。このため、これを防ぐ目的で膜全体をプラスチック製のネット状のものにより覆ったり、複数個の膜束に分割しそれぞれをネット状のもので覆い膜を均等に配列したものが一般的である。また、膜束の長さ方向に一定間隔に整束板や支持体を設置し、膜束を保持し乱れを押さえたモジュールも開発されている(特開平 1-307408, 実開平 2-28723)。

【0005】 これらの方法は、しかしながら、モジュールの運転において、定期的あるいは不定期的にエアスクラビングにより膜を揺らし、膜面に付着したゴミ、汚れなどを揺り落とす方法が採用される場合は、ネットや整束板により膜の揺れが規制され、付着物の除去性が悪くなる。このため、エアスクラビングによる付着物除去性が良く、膜束を中心パイプの回りに均等に配列でき

る手段が求められていた

【0006】。

【課題を解決するための手段】本発明の目的は、中空系膜束が外筒の中に収納され、接着剤で中空系膜束の少なくとも一端を気密に接着してなる中空系膜モジュールであって、モジュール内の中空系膜が固定されている端部表面は、(A) 固定されている中空系膜が密に分布している表面、(B) 固定されている中空系膜が実質上分布していない表面、を有し、かつ、表面(A) は表面(B) により、複数に分けられていることを特徴とする中空系膜モジュールにより基本的に達成される。

【0007】

【作用】係る構成を有することにより、つまり、中空系膜が膜束に分割されていることにより、エアースクラビングによる付着物除去性が良く、膜束を中心パイプの回りに均等に配列できる。しかも、モジュール内空間にネット、整束板または支持体を設置する必要がないので、中空系膜を傷付ける恐れもないものである。

【0008】即ち、モジュール内の中空系膜が固定されている端部表面に、固定されている中空系膜が実質上分布していない表面(B) を有することにより、モジュール内に、中空系膜が実質上分布していない空間が形成される。それにより、中空系膜の乱れが抑制され、かつ、エアースクラビングが均一に作用して、付着物除去性が向上するものである。係る空間は、処理対象流体や、中空系膜が自由に運動または存在できるものである。エアースクラビングが均一に行われる。また、該空間に存在する物質は、処理対象流体や中空系膜等のように、中空系膜よりも硬度の低いものである。エアースクラビングなどの際に、膜を傷付けることはない。係る空間を形成するには、前記の表面(B) が両端に存在することが好ましい。さらに好ましくは、両端部の表面(B) の形状が同じであり、特に好ましくは、両者の対応する部分が鏡像関係のように互いに正確に向かい合っている場合である。前記対応する部分が振じれた関係にあると、該空間も、振じれた形状となり、本願発明の効果が十分に発揮できなくなる。しかし、係る不都合が生じない程度ならば、両端部の表面(B) が、例えば面積比率で10%程度形状が異なっていたり、30度以内の範囲で振じれて向かい合わせていても問題はない。

【0009】また、表面(B) は、モジュール内に多少突出または、窪んでいても良いが、余り突出していると、エアースクラビング等で、中空系膜が振動するのが妨げられたり、あるいは中空系膜と当たって膜を傷付けたりする恐れがある。従って、表面(B) においては、処理対象流体や中空系膜等以外の、整束板や支持体や構造体などが存在する空間は、表面(A) から測った高さで、9mm以内とすることが好ましく、より好ましくは7mm以下である。一方、表面(B) が余り窪んでいると、処理流体の異常滞留を招き、汚染などの原因となる恐れがある。し

たがって、表面(B) が窪んでいる場合、表面(A) から測った深さで、9mm以内とすることが好ましく、より好ましくは7mm以下である。もっとも好ましくは、表面(B) は、モジュール内に突出または、窪んでいず、表面(A) と同じ高さを有していることである。

【0010】中空系膜の分割数は、2~10程度が好ましく、3~6がさらに好ましい。各分割の膜本数はモジュールの大きさによって異なるが、外径100mmのモジュールにおいては一束1000本から10000本程度が好ましい。また、膜束内の中空系膜の間隔は特に限定されるものではないが、2mm以下が好ましく、より好ましくは1mm以下である。

【0011】また、分割は、完全に分けられていることが好ましいが、中央部で繋がった花卉状のように、不完全な分割形態でも良い。ただし、その場合、分割し切れずに繋がっている部分の長さ(分割されている境界部分の境界線を分割し切れずに繋がっている部分に滑らかに延長して仮想的に引いた線の長さ)は、他の分割されている境界部分の境界線の長さの100%以下が好ましく、より好ましくは50%以下である。なお、境界線の設定方法は、表面(A) の最も外側の中空系膜に沿って、滑らかな線を引くことによるものとする。

【0012】また、表面(B) の幅は、3mm以上であることが好ましく、より好ましくは4mm以上である。この場合の幅は、最小値または平均値で評価した値で良い。平均値としては、例えば、1つの点を通して、表面(B) の境界で切られる線分中の最小長さを、表面(B) 上のすべての点について、平均することにより得られるものが挙げられるし、または、軸線を定義してその垂線と表面(B) の境界で切られる線分の長さの平均より求められるものもあげられる。

【0013】本願は、前述のように表面(B) により分割されるものである。つまり、中心パイプ部分以外の、接着端部に貫通した切欠部を設けることにより、分割するものではない。よって、接着端部の断面(モジュールの長軸あるいは中空系膜の走行方向に対して垂直に切断した断面)の外形が単純な円またはそれに近い形状とすることができ、接着端部の形成やモジュールの作成が容易である。

【0014】もちろん、係る形状以外の態様を排除するものではないが、前記の形成や作成の利点を考慮すると、仮に中心パイプ部分以外の接着端部の貫通した切欠部を有するとしても、その深さまたは幅は、好ましくは、直径の5分の1以下、より好ましくは、10分の1以下である。また、このような、貫通した切欠以外に、貫通していない、その他のパイプやセンサなどの穴なども特に排除するものではない。

【0015】本願発明にある表面(A) および表面(B) を形成する手段は、特に限定されるものではないが、接着剤固化部内部に、中空系膜束を保持するための整束板を

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用いることにより、表面(A)および表面(B)を形成する方法があげられる。一旦、表面(A)および表面(B)を形成された状態で、中空糸膜がモジュール端部に固定されれば、もはや、係る整束板は特に必要とするものではないので、固定端部より、剥離または分解することにより、除去することもできる。しかし、係る除去作業は、困難を伴うことが多いので、そのまま、整束板が接着剤固化部内部に一部または全て埋没していても良い。以下に、図面を踏まえて、特に、整束板が接着剤固化部内部に埋没した態様を用いて、本願発明をより詳細に説明する本発明に関わる実施例を図1、図3および図4に示す。

【0016】ろ過される供給水は多孔質中空糸ろ過膜モジュール（以下中空糸膜モジュールと呼ぶ）のノズル3より供給され、中空糸膜の表面にあいている無数の微細孔でろ過されて、SS成分や微粒子や、ごみ、細菌などが除かれた清澄水だけが中空糸膜内部に透過し、ろ過水出口11からろ過水として取り出される。中空糸膜モジュールのろ過においては原水圧力が大きいほどろ過水量は大きくなるが、ろ過時間の経過と共に前記SS成分、微粒子などが膜面に付着して多かれ少なかれ中空糸膜の目詰まりが生じ、同一圧力あたりのろ過水量が徐々に低下していくのが普通である。よって、中空糸膜、モジュールを長期に使用続けていくためには、中空糸膜の目詰まりが進行してろ過水量が低下した適当な時点において、エアースクラビングをはじめとする洗浄操作を行ない、目詰まり前に近いレベルにまで中空糸膜のろ過水量を回復させることが必要となってくる。

【0017】エアースクラビングを容器に充填された膜全体にわたり均一に行ない、洗浄効果を上げるには、膜の充填率を適当範囲に設定し、また、膜も容器に均一に分散した状態でなければならなくなる。

【0018】図2は一般的なモジュール構造であり容器1に充填された中空糸膜10は、中空糸膜の充填率が高い場合は、中空糸膜相互の摩擦のためモジュール製作時にも膜束が移動して膜束が乱れることはなかった。しかし、エアースクラビング等により膜を洗浄し、繰り返し使用し高寿命が必要なモジュール、特に全ろ過運転や高回収率運転を行なうモジュールにおいては高充填率であれば洗浄性も悪くなり、エアースクラビングを均一に実施することや、原水入口付近のおいての汚れ、ごみによる詰まりを招くことがわかった。これらを防ぐには中空糸膜の充填率を低くせざるを得なくなるが、モジュール製作上は、低充填率であれば、膜が乱れやすく出来上がったモジュールは膜が不均一に分散した状態になり、洗浄性が悪いのみならず見た目も悪くなる。特に中心パイプの回りに糸束を均一に充填させる必要がある場合は特に製作が困難であった。

【0019】本発明者らは、この低充填率の中空糸膜モジュールにおいても容器内に膜が均一に分散した状態で

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成形できる方法について鋭意検討を行なった結果、本発明を発見したものである。

【0020】本発明による整束板を使用して、その中に膜束を貫通させた状態において成形したモジュールは、膜乱れもなく、整束板の形状に合った形で膜束が容器内に均一に分散した状態において成形が可能となり、エアースクラビング等の洗浄操作が均一に行なうことが可能となる。また、整束板は接着剤中に埋没させることで、膜が直接整束板に接触することがなく中空糸膜も傷付かない。

【0021】このように、整束板を付設することで膜充填率の低いモジュールでも容器内に均一に分散したモジュールを製作できることを見出した。図1は本発明の整束板を用いたモジュールの説明図である。中心パイプ4の回りに中空糸膜10を4分割にして分散させ、中心パイプに接着した整束板5に中空糸膜を貫通させた状態で接着剤を封入し、成形したものである。接着剤硬化後、片側接着部のみ中空糸膜が開口する位置までカットしたもので、もう片方は、封止したままでその外側にモジュールキャップ2を付ける。整束板5は接着剤に埋没されており、中心パイプ4に開いた細孔からエアースクラビング用のエア出口孔7があり、反対側には、エアが抜けないように中心パイプ穴に盲栓9がはめられており、ろ過水側にエア、原水が混入しない構造になっている。

【0022】整束板は、膜の分割数によっていろんなタイプのものがあり、一例を図3、図4に示した。整束板は、中空糸膜束を貫通保持するため、中空糸膜が傷付かないように、バリがないように加工されていることが重要であり、中空糸膜接触部をなめらかにした射出成型品が使用される。

【0023】整束板の形状は、特に限定しないが円板状であることが好ましい。円板状整束板の外径は整束板を組み込む外筒の該当部分の内径と同寸法または小さいことが必要であるが、接着剤の流動性を向上させるために外筒内面と整束板外周との間に空間を設けることが特に好ましい。

【0024】さらに、整束板の仕切り部分にエア抜き用の貫通孔を設け、成形時の接着剤中のエアが抜け易い構造にすることが最も好ましい。貫通孔の大きさは、エアが抜ける程度の穴であればよく直径1～5mmφがよく、さらに好ましくは2～3mmφがよい。貫通孔の数はできるだけ多いほどよいが、膜の本数によって仕切り部分の厚みが制限されるため、通常一つの仕切りに2～3個の穴を開けると効果がある。整束板には中心パイプの貫通のための中心パイプ用穴を開けておくと中心パイプのセッティングが非常に容易であるが、本発明は必ずしも中心パイプを有することを前提とするものではなく、図4のように糸束を通す穴14とエア抜き用の貫通孔13だけを、あるいは糸束を通す穴14だけを有

するものでも良い。

【0025】整束板の材質は、特に指定はないが、接着剤性を考慮して容器、中心パイプと同じ材質が加工上好ましく、一般的にはポリ塩化ビニル、ポリカーボネート、ABS樹脂、ポリスルホン、ポリフェニレンスルフィド、ポリエーテルエーテルケトンなどが好ましく用いられる。

【0026】また、本発明に使用する中空糸膜を接着するために使用する接着剤としては、ウレタン系接着剤、エポキシ系接着剤、シリコン系接着剤等幅広く使用することができる。

【0027】本発明に使用する中空糸膜モジュールを構成する中空糸膜素材としては、多孔質に中空糸膜であれば特に限定しないが、ポリエチレン、ポリプロピレン、ポリスルホン、ポリエーテルスルホン、ポリビニルアルコール、セルロースアセテート、ポリアクリロニトリル、その他の材質を選択できる。この中で、特に好ましい中空糸膜素材としては、アクリロニトリルを少なくとも一成分とする重合体からなる中空糸膜が適当である。アクリロニトリルを少なくとも50モル%以上、好ましくは60モル%以上と該アクリロニトリルに対して共重合性を有するビニル化合物一種または二種以上を50%以下、好ましくは0~40モル%からなるアクリロニトリル系重合体である。また、これら、アクリロニトリル系重合体二種以上、さらに他の重合体との混合物でもよい。上記ビニル化合物としては、アクリロニトリルに対して共重合性を有する公知の化合物であればよく、特に限定されないが、このましい共重合体としては、アクリル酸、イタコン酸、アクリル酸メチル、メタクリル酸メチル、酢酸ビニル、アリルスルホン酸ソーダ、p-スチレンスルホン酸ソーダ等を例示することができる。

【0028】

【実施例】

実施例1

外径850 $\mu$ m、内径350 $\mu$ mのポリアクリロニトリルの中空糸膜10000本を2500本、4束に分割した中空糸膜束を、パイプの一部に2mm $\phi$ 穴が24個開いた長さ1110mmの中心パイプの両端からそれぞれ約100mmの位置に取り付けた整束板に1束づつとおした。これを外径114mm $\phi$ 、内径100mm $\phi$ の透明外筒の中に充填し両端をシールした後、遠心成形機にセットし回転中に接着剤を、外筒のノズル口から接着剤が二分するように250g投入し、30分後、さらに接着剤を500g投入した。接着剤硬化後、外筒の片方をチップソー式切断機により20mmカットした。さらに、外筒両側にキャップを接着しモジュールを製作した。製作したモジュールを構成する4束の中空糸膜束は

全く均一に配置されており、各糸束には単糸乱れは観察されなかった。これを用い、濁度5の湖水を15リットル/分の濾過水が得られるようにモジュール評価装置をセットしたところ、供給圧力は0.50kg/cm<sup>2</sup>であった。24間直接通水したところ、膜面が茶色く汚れたのでエアースクラビングをエア一量30リットル/分で、5分間おこなったところ、膜面の汚れは外観上通水前と変わらないまでに回復した。再びスタートした時の供給圧力は0.50kg/cm<sup>2</sup>であった。

【0029】比較例1

中心パイプと整束板を使用しないほかは、実施例1と同じ方法によりモジュールを製作したところ、膜束が片方に片寄っているのがわかった。このモジュールを用いて濁度5の湖水を15リットル/分の濾過水が得られるようにモジュール評価装置をセットしたところ、供給圧力は0.50kg/cm<sup>2</sup>であった。24時間通水したところ、膜面が茶色く汚れたのでエアースクラビングをエア一量30リットル/分、5分間行なったところ、エア一が膜のないところを殆ど通り、膜面の汚れは殆ど落ちなかった。再びスタートした時の供給圧力は0.60kg/cm<sup>2</sup>であった。

【0030】

【発明の効果】本発明により、微粒子や懸濁物質を含んだ液体を連続ろ過し、しかも定期的にエアースクラビングを行なうことで中空糸膜の目詰まりを除去することが可能な中空糸膜モジュールが提供される。

【図面の簡単な説明】

【図1】本発明の整束板を使用したモジュールの構成概略図

【図2】従来のモジュールの概略構成図

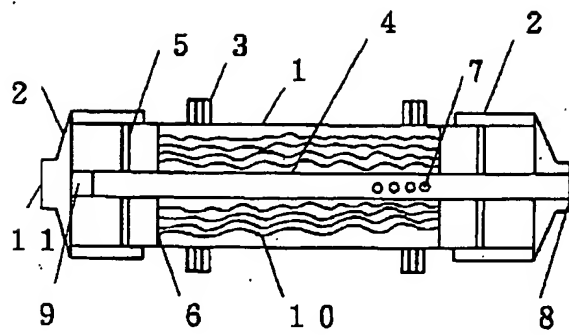
【図3】中心パイプの穴を有する整束板の一例

【図4】中心パイプの穴を有しない整束板の一例

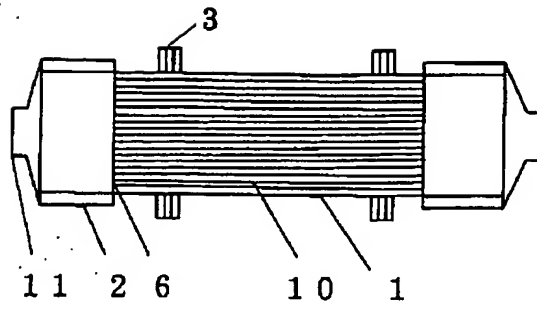
【符号の説明】

- 1：外筒（容器）
- 2：モジュールキャップ
- 3：ノズル
- 4：中心パイプ
- 5：整束板
- 6：封止剤（接着剤）
- 7：エア一出口孔
- 8：エア一供給口
- 9：盲栓
- 10：中空糸膜
- 11：ろ過水出口
- 12：エア一抜き穴
- 13：中心パイプ接続穴
- 14：中空糸膜貫通穴

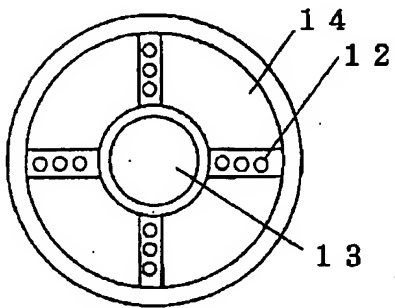
【図1】



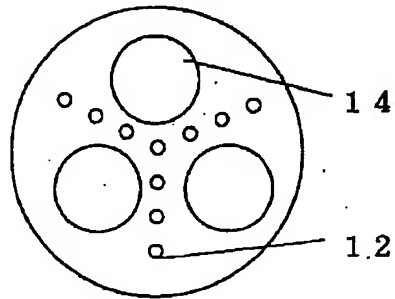
【図2】



【図3】



【図4】



## PATENT ABSTRACTS OF JAPAN

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(72)Inventor :

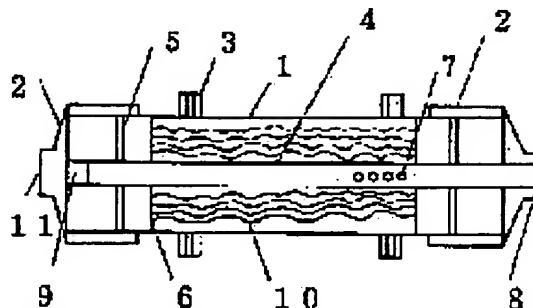
**NISHIMURA TETSUO**  
**YAMAMURA HIROYUKI**

### (54) HOLLOW YARN MEMBRANE MODULE

(57)Abstract:

**PURPOSE:** To improve the removing efficiency of a bonded substance by air scrubbing by providing a surface having hollow yarn membranes densely distributed thereon and a surface having no hollow yarn membranes distributed thereon to the surface of the end part to which hollow yarn bundles are fixed in a module to separate the end part into a plurality of sections by the surfaces A, B.

**CONSTITUTION:** The bundles of hollow yarn membranes 10 are received in an outer cylinder 1 and at least one ends thereof are bonded airtightly by an adhesive 6. In this hollow yarn membrane module, a surface A having the fixed hollow yarn membranes 10 densely distributed thereon and a surface B having the fixed hollow yarn membranes 10 not substantially distributed thereon are provided to the surface of the end part to which the hollow yarn membranes 10 are fixed in the module and the surface of the end part is separated into a plurality of sections by the surfaces A, B. As a result, the hollow yarn membrane module improved in clogging removing effect due to air scrubbing to a large extent can be obtained.



### LEGAL STATUS

[Date of request for examination]

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[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

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[Date of extinction of right]

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**JAPANESE** [JP,07-136471,A]

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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM  
MEANS OPERATION EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

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[Translation done.]



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CLAIMS

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[Claim(s)]

[Claim 1] A hollow fiber bunch is contained in an outer case, and is the hollow fiber module of a hollow fiber bunch which it comes to paste an end airtightly at least with adhesives. The edge surface where a hollow fiber in a module is being fixed (A) The surface over which a hollow fiber currently fixed is distributed densely, and (B) It has the surface over which a hollow fiber currently fixed is not distributed on parenchyma, and is the surface (A). The surface (B) A hollow fiber module characterized by being divided into plurality.

[Claim 2] The surface of claim 1 (B) A hollow fiber module according to claim 1 with which width of face is characterized by being 3mm or more.

[Claim 3] It is the surface (A) according to claim 1 by using ready \*\*\*\* for holding a hollow fiber bunch for the interior of the adhesives solidification section. And the surface (B) A hollow fiber module according to claim 1 characterized by forming.

[Claim 4] A hollow fiber module according to claim 3 characterized by having buried ready \*\*\*\* according to claim 3 in the interior of the adhesives solidification section.

[Claim 5] A hollow fiber module according to claim 3 characterized by preparing a through tube for promoting circulation of adhesives and air other than space for carrying out penetration maintenance of the hollow fiber on ready \*\*\*\*.

[Claim 6] A hollow fiber module according to claim 1 characterized by arranging around a pipe a hollow fiber bunch by which a hollow fiber bunch was divided and divided into two or more bunches.

[Claim 7] A hollow fiber module according to claim 1 characterized by a hollow fiber which constitutes a hollow fiber module consisting of a polymer which uses acrylonitrile as at least 1 component.

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[Translation done.]

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the hollow fiber module for performing filtration actuation of a liquid.

[0002]

[Description of the Prior Art] if many SS components, a particle, dust, bacteria, algae, etc. are contained in common industrial water and it is used as it is -- service water -- it is easy to become the cause which produces troubles, such as plugging of piping, bacterial growth, and scale deposition in Rhine. In order to remove these underwater mixing components conventionally, various methods, such as sand filtration, condensation filtration, coagulation sedimentation filtration, and cartridge filtration, have been responded and used for a use. Filtration by the porous hollow fiber is beginning to put in practical use as the new technique of changing to such general filtration recently. The water treatment by the hollow fiber and filtration spread quickly in recent years, and are becoming large [ the Field of application ] every year.

[0003] In filtration of a hollow fiber, after a hollow fiber bundles what 1000 - what [ 10,000 ] in a bunch, it is processed into the goods gestalt of the configuration which fixed the edge with adhesives. And what was processed into these goods gestalten is called the hollow fiber module. As a hollow fiber module which can filter a liquid, the thing of many gestalten is proposed from the former. There are a filtration module used especially as an early thing combining a moderate pretreatment means, a thing aiming at reverse osmosis filtration, a thing aiming at a dialysis use, etc., many module gestalten are proposed by making these uses into a key objective, and when the main thing is mentioned, there are some which are indicated by JP,48-28380,B, JP,49-69550,A, JP,53-100176,A, etc. As for these all, in filtering a liquid, in throwing away or the phase in which dirt adhered more than the constant rate, it was common to have carried out washing and the Flushing processing by clarified water or drug solution water. On the other hand, a hollow fiber module configuration is elaborated recently and the method of carrying out engine-performance recovery of a hollow fiber by Ayr is tried. JP,61-263605,A includes a hollow fiber in a U character mold, contains and uses it for a container, makes Ayr introduce from the Ayr inlet periodically established in the lower part of a container, vibrates a hollow fiber by Ayr scrubbing, and tries removal of the sediment of a film surface. Moreover, JP,60-206415,A is the both-ends cover-half module which made the hollow fiber arrange around a central tube, and is said thing which includes in a container similarly and removes the sediment of a hollow fiber film surface by Ayr scrubbing. As for such technology, examination of utilization is already started.

[0004]

[Problem(s) to be Solved by the Invention] In the manufacture method of a hollow fiber module, although the attempt which makes a hollow fiber arrange around a central tube is generally used well, the following technical problem is left behind in the present module. That is, it is difficult to arrange what 1000 - what 10,000 \*\* for a hollow fiber equally around a central tube, and when both ends are closed for a hollow fiber with adhesives in an array and the condition of having tacking carried out, around a central tube, it is difficult [ it ] to obtain the hollow fiber module with which the hollow fiber bunch fell caudad with gravity, and was equally arranged in the hollow fiber in the setting time of adhesives. For this reason, the whole film is divided into two or more \*\*\*\* [ \*\*\*\* / covering by the thing of the shape of a network made from plastics ] in order to prevent this, and it is a network-like thing about each, and what arranged the cover film equally is common. Moreover, ready \*\*\*\* and a base material are installed in the length direction of \*\*\*\* at fixed interval, and the module which held \*\*\*\* and pressed down turbulence is also developed (publication number 1-307408, the real extraction of the square root 2-28723).

[0005] Carrying out the deer of these methods, in operation of a module, a film is swayed by Ayr scrubbing periodically or irregularly, when \*\*\*\* and \*\*\*\*\* are adopted in dust, dirt, etc. adhering to a film surface, the shake of a film is regulated by a network and ready \* \*\*, and the removal nature of an affix worsens. For this reason, [0006] which the affix removal nature by Ayr scrubbing was good for, and was asked for a means by which \*\*\*\* can be equally arranged around a central tube .

[Means for Solving the Problem] A hollow fiber bunch is contained in an outer case, and the purpose of this invention is a hollow fiber module of a hollow fiber bunch which it comes to paste an end airtightly at least with adhesives. The edge surface where a hollow fiber in a module is being fixed (A) The surface over which a hollow fiber currently fixed is distributed densely, and (B) It has the surface over which a hollow fiber currently fixed is not distributed on parenchyma, and is the surface (A). Surface (B) It is fundamentally attained by hollow fiber module characterized by being divided into plurality.

[0007]

[Function] Having the starting configuration, i.e., by dividing the hollow fiber into \*\*\*\*, the affix removal nature by Ayr scrubbing is good, and can arrange \*\*\*\* equally around a central tube. And since it is not necessary to install a network, ready \*\*\*\*, or a base material in the space in a module, there is also no possibility of damaging a hollow fiber.

[0008] Namely, the surface from which the hollow fiber currently fixed is not distributed over the edge surface on which the hollow fiber in a module is being fixed on parenchyma (B) By having, the space from which the hollow fiber is not distributed on parenchyma in a module is formed. By that cause, turbulence of a hollow fiber is controlled, and Ayr scrubbing acts on homogeneity, and affix removal nature improves. Since a processing-object fluid and a hollow fiber can exercise or exist freely, as for the starting space, Ayr scrubbing is carried out to homogeneity. Moreover, like a processing-object fluid or a hollow fiber, since a degree of hardness is lower than a hollow fiber, the material which exists in this space does not damage a film in the cases, such as Ayr scrubbing. In order to form the starting space, it is the aforementioned surface (B). Existing in both ends is desirable. It is the surface (B) of both ends still more preferably. A configuration is the same and it is the case where the portion to which both correspond faces correctly mutually like mirror image-related preferably especially. When it has the relation in which said corresponding portion was twisted, this space also serves as a twisted configuration and it becomes impossible for the effect of the invention in this application to fully demonstrate it. However, if it is the degree which un-arranging [ starting ] does not produce, it is the surface (B) of both ends. For example, it is satisfactory, even if configurations differ about 10% or it is making each other twist and face in less than 30 degrees at the rate of surface ratio.

[0009] Moreover, the surface (B) There is a possibility of a hollow fiber being somewhat prevented from a protrusion or being Ayr scrubbing etc. and vibrating if it has projected not much, although you may become depressed in a module, or hitting with a hollow fiber and damaging a film. therefore, the surface (B) the space where it sets and ready \*\*\*\* and the base materials of an except, such as a processing-object fluid and a hollow fiber, the structure, etc. exist -- the surface (A) from -- it is the measured height, and it is desirable to be referred to as less than 9mm, and it is 7mm or less more preferably. On the other hand, it is the surface (B). When it has become depressed not much, abnormality stagnation of a processing fluid is caused and there is a possibility of becoming causes, such as contamination. therefore, the surface (B) the case where it has become depressed -- the surface (A) from -- it is the measured depth, and it is desirable to be referred to as less than 9mm, and it is 7mm or less more preferably. But it is the surface (B) preferably. It has not projected or become depressed in the module, and is the surface (A). It is having the same height.

[0010] As for the number of partitions of a hollow fiber, two to about ten are desirable, and 3-6 are still more desirable. Although the film number of each division changes with magnitude of MOJURU, in a module with an outer diameter of 100mm, about 10000 are desirable from 1000 per bundle. Moreover, although especially the gap of the hollow fiber in \*\*\*\* is not limited, its 2mm or less is desirable, and it is 1mm or less more preferably.

[0011] Moreover, although being divided completely is desirable as for division, an imperfect division gestalt is sufficient as it like the petaloid connected in the center section. However, it divides in that case, and 100% or less into which others are divided of the length of the boundary line of a boundary portion of the length (the length of the line which extended smoothly the boundary line of the boundary portion currently divided into the portion connected without dividing and going out, and drew it virtually into it) of the portion connected without going out is desirable, and it is 50% or less more preferably. In addition, the setting method of a boundary line is the surface (A). Along with the outermost hollow fiber, it shall be because a smooth line is drawn.

[0012] Moreover, the surface (B) As for width of face, it is desirable that it is 3mm or more, and it is 4mm or more more preferably. The width of face in this case is good at the value evaluated by the minimum value or the average. As the average, one point is passed and it is the surface (B), for example. About the minimum length in the segment cut on a boundary, it is the surface (B). What is obtained by averaging about all the upper points is mentioned, or an axis is defined, and it is the perpendicular and surface (B). What is called for from the average of the length of the segment cut on a boundary is raised.

[0013] This application is the surface (B) as mentioned above. It is divided. That is, it does not divide by preparing the notch penetrated at the adhesion edges other than a central-tube portion. Therefore, since the appearance of the cross section (cross section perpendicularly cut to the modular major axis or the transit direction of a hollow fiber) of an adhesion edge can consider as the configuration near a simple circle or simple it, formation of an adhesion edge and modular creation are easy.

[0014] of course -- even if it has the notch which adhesion edges other than a central-tube portion penetrated when the advantage of the aforementioned formation or creation is taken into consideration although any modes other than the applied configuration are not eliminated -- the depth or width of face -- desirable -- 1/5 or less [ of a diameter ] -- more -- desirable -- 1/10 or less -- it is . Moreover, especially holes, such as such other pipes which have not been penetrated other than the penetrated notch, a sensor, etc., etc. are not eliminated.

[0015] The surface in the invention in this application (A) And the surface (B) Especially a means to form is the surface (A) by using ready \*\*\*\* for holding a hollow fiber bunch for the interior of the adhesives solidification section, although not limited. And the surface (B) The method of forming is raised. It is once the surface (A). And the surface (B) If a hollow fiber is fixed to a module edge in the condition of having been formed, since especially starting ready \*\*\*\* does not need any longer, it is also removable from the fixed-end section by exfoliating or decomposing. however -- since the starting removal is accompanied by difficulty in many cases -- as it is -- ready \*\*\*\* -- the interior of the adhesives solidification section -- a part -- or it may be buried altogether. The example in connection with this invention which explains the invention in this application more below at details using the mode in which ready \*\*\*\* was especially buried in the interior of the adhesives solidification section based on a drawing is shown in drawing 1 , drawing 3 , and drawing 4 .

[0016] The feedwater filtered is supplied from the nozzle 3 of a porosity hollow filament filtration membrane module (it is called a hollow fiber module below), is filtered by the countless micropore which has opened on the surface of the hollow fiber, and only the clarified water with which SS component, a particle, a contaminant, bacteria, etc. were removed penetrates it inside a hollow fiber, and it is taken out from the filtered water outlet 11 as filtered water. Although the amount of filtered water becomes large so that a raw water pressure is large in filtration of a hollow fiber module, said SS component, a particle, etc. adhere to a film surface with the filtration passage of time, the blinding of a hollow fiber arises to some extent, and, usually the amount of filtered water per same pressure falls gradually. Therefore, when [ suitable ] the blinding of a hollow fiber advances to eye a use \*\*\*\*\* many and the amount of filtered water falls a hollow fiber and

a module to it at a long period of time, washing actuation including Ayr scrubbing is performed, and it is necessary even for level near before blinding to recover the amount of filtered water of a hollow fiber.

[0017] In order to perform Ayr scrubbing on the whole film filled up by the container at rear-spring-supporter homogeneity and to raise a cleaning effect, it must stop having to be in the condition which set the membranous filling factor as the suitable range, and also distributed the film in the container at homogeneity.

[0018] When the hollow fiber 10 with which drawing 2 is general module structure and the container 1 was filled up had the high filling factor of a hollow fiber, \*\*\*\* moved also at the time of module manufacture for friction between hollow fibers, and \*\*\*\* was not confused. However, it turned out by Ayr scrubbing's etc. washing a film and carrying out repeat use that plugging by detergency also worsening and carrying out Ayr scrubbing to homogeneity, the dirt which near a raw water entrance sets, and the contaminant will be caused if it is a high filling factor in the module which needs a high life, especially the module which performs all filtration operations and high recovery operation. Although the filling factor of a hollow fiber must be made low for preventing these, if a module manufacture top is a low filling factor, detergency is not only bad, but the module with which the film was turbulence-easy with the module and was done will be distributed by the film to an ununiformity, and appearance will worsen. Manufacture was difficult especially when it was necessary to make homogeneity fill up especially the surroundings of a central tube with a thread.

[0019] this invention persons discover this invention, as a result of examining wholeheartedly the method of fabricating after the film has distributed to homogeneity in a container also in the hollow fiber module of this low filling factor.

[0020] The module fabricated in the condition of having used ready \*\*\*\* by this invention and having made \*\*\*\* penetrating in it does not have film turbulence, either, shaping becomes possible in the condition that \*\*\*\* distributed to homogeneity in the container in the form suitable for the configuration of ready \*\*\*\*, and washing actuation of Ayr scrubbing etc. becomes possible [ carrying out to homogeneity ]. Moreover, ready \*\*\*\* is making it buried into adhesives, and a film does not contact ready \*\*\*\* directly and it does not have a hollow fiber with a blemish, either.

[0021] Thus, it found out that the module which also distributed the low module of a film filling factor to homogeneity in the container could be manufactured by attaching ready \*\*\*\*. Drawing 1 is explanatory drawing of the module which used ready \*\*\*\* of this invention. Quadrisection is distributed by carrying out a hollow fiber 10 around a central tube 4, and adhesives are enclosed and fabricated in the condition of having made ready \*\*\*\* 5 pasted up on the central tube penetrating a hollow fiber. It is what was cut to the location where a hollow fiber carries out the opening only of the single-sided jointing after adhesive setting, and one of the two already attaches the module cap 2 to the outside, closing. It is buried in adhesives and there is an Ayr outlet hole 7 for Ayr scrubbing from the pore opened to the central tube 4, the plug 9 is inserted in the central-tube hole so that Ayr may not fall out in the opposite side, and ready \*\*\*\* 5 has structure which Ayr and raw water do not mix in a filtered water side.

[0022] By the membranous number of partitions, ready \*\*\*\* has a thing various type and showed an example to drawing 3 and drawing 4 . It is important for ready \*\*\*\* in order to carry out penetration maintenance of the hollow fiber bunch, to be processed so that there may be no hollow fiber with a blemish, and there may be no weld flash, and the injection molding article which smoothed the hollow fiber contact section is used.

[0023] Although especially the configuration of ready \*\*\*\* is not limited, it is desirable that it is disc-like. Although the outer diameter of disc-like ready \*\*\*\* needs the bore of the applicable portion of the outer case incorporating ready \*\*\*\*, this size, or a small thing, in order to raise the fluidity of adhesives, especially the thing established for space between an outer case inside and a ready \*\*\*\* periphery is desirable.

[0024] Furthermore, it is most desirable to make it the structure from which prepares the through tube for degassing in the partition portion of ready \*\*\*\*, and Ayr in the adhesives at the time of shaping tends to escape. The diameter phi of 1-5mm has [ the magnitude of a through tube / that what is necessary is just the hole which is the degree from which Ayr escapes ] at best still more preferably good 2-3mmphi. Although it is so good that there are as much as possible many penetration openings, since it divides by the membranous number and the thickness of a portion is restricted, it is effective when 2-3 holes are made in the partition which is usually one. Although setting of a central tube is very easy if the hole for central tubes for penetration of a central tube is made in ready \*\*\*\*, this invention may not necessarily be premised on having a central tube, and may have only the hole 14 which lets a thread pass like drawing 4 , and the hole 14 which lets the through tube 13 for degassing, or a thread pass.

[0025] Although the quality of the material of ready \*\*\*\* does not have especially assignment, in consideration of adhesives nature, the same quality of the material as a container and a central tube is desirable on processing, and, generally a polyvinyl chloride, a polycarbonate, ABS plastics, polysulfone, a polyphenylene sulfide, a polyether ether ketone, etc. are used preferably.

[0026] Moreover, as adhesives used in order to paste up the hollow fiber used for this invention, urethane system adhesives, epoxy system adhesives, silicon system adhesives, etc. can be used broadly.

[0027] Although it will not limit to porosity as a hollow fiber material which constitutes the hollow fiber module used for this invention especially if it is a hollow fiber, the quality of the material of polyethylene, polypropylene, polysulfone, polyether sulphone, polyvinyl alcohol, cellulose acetate, a polyacrylonitrile, and others can be chosen. In this, the hollow fiber which consists of a polymer which uses acrylonitrile as at least 1 component as a desirable hollow fiber material especially is suitable. It is the acrylonitrile system polymer which consists preferably of 0-40-mol % at least more than 50 mol %, a vinyl compound kind which has copolymerization nature to more than 60 mol % and this acrylonitrile preferably, or two sorts or more 50% or less in acrylonitrile. Moreover, mixture with two or more sorts of these acrylonitrile system polymers and the polymer of further others is sufficient. That what is necessary is just the well-known compound which has copolymerization nature to acrylonitrile as the above-mentioned vinyl compound, although not limited especially, as this better \*\*\*\*\*, an acrylic acid, an itaconic acid, a methyl acrylate, a methyl methacrylate, vinyl acetate, allyl compound sulfonic acid soda, p-sodium styrenesulfonate, etc. can be illustrated.

[0028]

[Example]

It let one bundle pass at a time to ready \*\*\*\* attached in the location of about 100mm, respectively from the both ends of the central tube with a length of 1110mm with which 24 2mmphi holes opened the hollow fiber bunch which divided 10000 hollow fibers of a polyacrylonitrile with an outer diameter [ example 1 / of 850 micrometers ], and a bore of 350 micrometers into 2500 and four bundles to some pipes. After filling up inside with this at outer-diameter 114mmphi and a transporence outer case with a bore [ phi ] of 100mm and carrying out the seal of the both ends, 250g was supplied so that it might set to a centrifugal molding machine and adhesives might bisect adhesives from nozzle opening of an outer case during rotation, and 500g of adhesives was further thrown in after 30 minutes. One of the two of an outer case was cut 20mm with the chip sow type slicing machine after adhesive setting. Furthermore, the cap was pasted up on outer case both sides, and the module was manufactured. Four bundles of hollow fiber bunches which constitute the manufactured module are completely arranged at homogeneity, and single-yarn turbulence was not observed by each thread. The supply pressure was 0.50kg/cm<sup>2</sup>, when module evaluation equipment was set using this so that 15l. \*\*\*\*\* for /might be obtained in the lake of turbidity 5. Since the film surface became dirty brown when it let water flow directly between 24, when Ayr scrubbing was performed for 5 minutes by part for amount/of 30l. of Ayr, by the time the dirt of a film surface was not different from before exterior water flow, it was recovered. The supply pressure when starting again was 0.50kg/cm<sup>2</sup>.

[0029] When example of comparison 1 central tube and ready \*\*\*\* were not used and also the module was manufactured by the same method as an example 1, it turned out that \*\*\*\* inclines toward one of the two. The supply pressure was 0.50kg/cm<sup>2</sup>, when module evaluation equipment was set so that 15l. \*\*\*\*\* for /might be obtained in the lake of turbidity 5 using this module. Since the film surface became dirty brown when it let water flow for 24 hours, when Ayr scrubbing was performed for [ amount / of 30l. / of Ayr ] a part for /, and 5 minutes, it almost passed along the place where a film does not have Ayr, and the dirt of a film surface hardly came off. The supply pressure when starting again was 0.60kg/cm<sup>2</sup>.

[0030]

[Effect of the Invention] By this invention, continuation filtration of the liquid containing a particle or a suspended solid is carried out, and the hollow fiber module which can remove the blinding of a hollow fiber by moreover performing Ayr scrubbing periodically is offered.

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[Translation done.]

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TECHNICAL FIELD

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[Industrial Application] This invention relates to the hollow fiber module for performing filtration actuation of a liquid.

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PRIOR ART

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[Description of the Prior Art] if many SS components, a particle, dust, bacteria, algae, etc. are contained in common industrial water and it is used as it is -- service water -- it is easy to become the cause which produces troubles, such as plugging of piping, bacterial growth, and scale deposition in Rhine. In order to remove these underwater mixing components conventionally, various methods, such as sand filtration, condensation filtration, coagulation sedimentation filtration, and cartridge filtration, have been responded and used for a use. Filtration by the porous hollow fiber is beginning to put in practical use as the new technique of changing to such general filtration recently. The water treatment by the hollow fiber and filtration spread quickly in recent years, and are becoming large [ the Field of application ] every year.

[0003] In filtration of a hollow fiber, after a hollow fiber bundles what 1000 - what [ 10,000 ] in a bunch, it is processed into the goods gestalt of the configuration which fixed the edge with adhesives. And what was processed into these goods gestalten is called the hollow fiber module. As a hollow fiber module which can filter a liquid, the thing of many gestalten is proposed from the former. There are a filtration module used especially as an early thing combining a moderate pretreatment means, a thing aiming at reverse osmosis filtration, a thing aiming at a dialysis use, etc., many module gestalten are proposed by making these uses into a key objective, and when the main thing is mentioned, there are some which are indicated by JP,48-28380,B, JP,49-69550,A, JP,53-100176,A, etc. As for these all, in filtering a liquid, in throwing away or the phase in which dirt adhered more than the constant rate, it was common to have carried out washing and the Flushing processing by clarified water or drug solution water. On the other hand, a hollow fiber module configuration is elaborated recently and the method of carrying out engine-performance recovery of a hollow fiber by Ayr is tried. JP,61-263605,A includes a hollow fiber in a U character mold, contains and uses it for a container, makes Ayr introduce from the Ayr inlet periodically established in the lower part of a container, vibrates a hollow fiber by Ayr scrubbing, and tries removal of the sediment of a film surface. Moreover, JP,60-206415,A is the both-ends cover-half module which made the hollow fiber arrange around a central tube, and is said thing which includes in a container similarly and removes the sediment of a hollow fiber film surface by Ayr scrubbing. As for such technology, examination of utilization is already started.

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EFFECT OF THE INVENTION

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[Effect of the Invention] By this invention, continuation filtration of the liquid containing a particle or a suspended solid is carried out, and the hollow fiber module which can remove the blinding of a hollow fiber by moreover performing Ayr scrubbing periodically is offered.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] In the manufacture method of a hollow fiber module, although the attempt which makes a hollow fiber arrange around a central tube is generally used well, the following technical problem is left behind in the present module. That is, it is difficult to arrange what 1000 - what 10,000 \*\* for a hollow fiber equally around a central tube, and when both ends are closed for a hollow fiber with adhesives in an array and the condition of having tacking carried out, around a central tube, it is difficult [ it ] to obtain the hollow fiber module with which the hollow fiber bunch fell caudad with gravity, and was equally arranged in the hollow fiber in the setting time of adhesives. For this reason, the whole film is divided into two or more \*\*\*\* [ \*\*\*\* / covering by the thing of the shape of a network made from plastics ] in order to prevent this, and it is a network-like thing about each, and what arranged the cover film equally is common. Moreover, ready \*\*\*\* and a base material are installed in the length direction of \*\*\*\* at fixed interval, and the module which held \*\*\*\* and pressed down turbulence is also developed (publication number 1-307408, the real extraction of the square root 2-28723).

[0005] Carrying out the deer of these methods, in operation of a module, a film is swayed by Ayr scrubbing periodically or irregularly, when \*\*\*\*\* and \*\*\*\*\* are adopted in dust, dirt, etc. adhering to a film surface, the shake of a film is regulated by a network and ready \* \*\*\*, and the removal nature of an affix worsens. For this reason, the affix removal nature by Ayr scrubbing was good, and a means by which \*\*\*\* could be equally arranged around a central tube was searched for. [0006] .

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MEANS

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[Means for Solving the Problem] A hollow fiber bunch is contained in an outer case, and the purpose of this invention is a hollow fiber module of a hollow fiber bunch which it comes to paste an end airtightly at least with adhesives. The edge surface where a hollow fiber in a module is being fixed (A) The surface over which a hollow fiber currently fixed is distributed densely, and (B) It has the surface over which a hollow fiber currently fixed is not distributed on parenchyma, and is the surface (A). Surface (B) It is fundamentally attained by hollow fiber module characterized by being divided into plurality.

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## OPERATION

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[Function] Having the starting configuration, i.e., by dividing the hollow fiber into \*\*\*\*, the affix removal nature by Ayr scrubbing is good, and can arrange \*\*\*\* equally around a central tube. And since it is not necessary to install a network, ready \*\*\*\*, or a base material in the space in a module, there is also no possibility of damaging a hollow fiber.

[0008] Namely, the surface from which the hollow fiber currently fixed is not distributed over the edge surface on which the hollow fiber in a module is being fixed on parenchyma (B) By having, the space from which the hollow fiber is not distributed on parenchyma in a module is formed. By that cause, turbulence of a hollow fiber is controlled, and Ayr scrubbing acts on homogeneity, and affix removal nature improves. Since a processing-object fluid and a hollow fiber can exercise or exist freely, as for the starting space, Ayr scrubbing is carried out to homogeneity. Moreover, like a processing-object fluid or a hollow fiber, since a degree of hardness is lower than a hollow fiber, the material which exists in this space does not damage a film in the cases, such as Ayr scrubbing. In order to form the starting space, it is the aforementioned surface (B). Existing in both ends is desirable. It is the surface (B) of both ends still more preferably. A configuration is the same and it is the case where the portion to which both correspond faces correctly mutually like mirror image-related preferably especially. When it has the relation in which said corresponding portion was twisted, this space also serves as a twisted configuration and it becomes impossible for the effect of the invention in this application to fully demonstrate it. However, if it is the degree which un-arranging [ starting ] does not produce, it is the surface (B) of both ends. For example, it is satisfactory, even if configurations differ about 10% or it is making each other twist and face in less than 30 degrees at the rate of surface ratio.

[0009] Moreover, the surface (B) There is a possibility of a hollow fiber being somewhat prevented from a protrusion or being Ayr scrubbing etc. and vibrating if it has projected not much, although you may become depressed in a module, or hitting with a hollow fiber and damaging a film. therefore, the surface (B) the space where it sets and ready \*\*\*\* and the base materials of an except, such as a processing-object fluid and a hollow fiber, the structure, etc. exist -- the surface (A) from -- it is the measured height, and it is desirable to be referred to as less than 9mm, and it is 7mm or less more preferably. On the other hand, it is the surface (B). When it has become depressed not much, abnormality stagnation of a processing fluid is caused and there is a possibility of becoming causes, such as contamination. therefore, the surface (B) the case where it has become depressed -- the surface (A) from -- it is the measured depth, and it is desirable to be referred to as less than 9mm, and it is 7mm or less more preferably. But it is the surface (B) preferably. It has not projected or become depressed in the module, and is the surface (A). It is having the same height.

[0010] As for the number of partitions of a hollow fiber, two to about ten are desirable, and 3-6 are still more desirable. Although the film number of each division changes with magnitude of MOJURU, in a module with an outer diameter of 100mm, about 10000 are desirable from 1000 per bundle. Moreover, although especially the gap of the hollow fiber in \*\*\*\* is not limited, its 2mm or less is desirable, and it is 1mm or less more preferably.

[0011] Moreover, although being divided completely is desirable as for division, an imperfect division gestalt is sufficient as it like the petaloid connected in the center section. However, it divides in that case, and 100% or less into which others are divided of the length of the boundary line of a boundary portion of the length (the length of the line which extended smoothly the boundary line of the boundary portion currently divided into the portion connected without dividing and going out, and drew it virtually into it) of the portion connected without going out is desirable, and it is 50% or less more preferably. In addition, the setting method of a boundary line is the surface (A). Along with the outermost hollow fiber, it shall be because a smooth line is drawn.

[0012] Moreover, the surface (B) As for width of face, it is desirable that it is 3mm or more, and it is 4mm or more more preferably. The width of face in this case is good at the value evaluated by the minimum value or the average. As the average, one point is passed and it is the surface (B), for example. About the minimum length in the segment cut on a boundary, it is the surface (B). What is obtained by averaging about all the upper points is mentioned, or an axis is defined, and it is the perpendicular and surface (B). What is called for from the average of the length of the segment cut on a boundary is raised.

[0013] This application is the surface (B) as mentioned above. It is divided. That is, it does not divide by preparing the notch penetrated at the adhesion edges other than a central-tube portion. Therefore, since the appearance of the cross section (cross section perpendicularly cut to the modular major axis or the transit direction of a hollow fiber) of an adhesion edge can consider as the configuration near a simple circle or simple it, formation of an adhesion edge and modular creation are easy.

[0014] of course -- even if it has the notch which adhesion edges other than a central-tube portion penetrated when the advantage of the aforementioned formation or creation is taken into consideration although any modes other than the applied configuration are not eliminated -- the depth or width of face -- desirable -- 1/5 or less [ of a diameter ] -- more -- desirable -- 1/10 or less -- it is . Moreover, especially holes, such as such other pipes which have not been penetrated other than the penetrated notch, a sensor, etc., etc. are not eliminated.

[0015] The surface in the invention in this application (A) And the surface (B) Especially a means to form is the surface (A) by using ready \*\*\*\* for holding a hollow fiber bunch for the interior of the adhesives solidification section, although not limited. And the surface (B) The method of forming is raised. It is once the surface (A). And the surface (B) If a hollow fiber is fixed to a module edge in the condition of having been formed, since especially starting ready \*\*\*\* does not need any longer, it is also removable from the fixed-end section by exfoliating or decomposing. however -- since the starting removal is accompanied by difficulty in many cases -- as it is -- ready \*\*\*\* -- the interior of the adhesives solidification section -- a part -- or it may be buried altogether. The example in connection with this invention which explains the invention in this application more below at details using the mode in which ready \*\*\*\* was especially buried in the interior of the adhesives solidification section based on a drawing is shown in drawing 1 , drawing 3 , and drawing 4 .

[0016] The feedwater filtered is supplied from the nozzle 3 of a porosity hollow filament filtration membrane module (it is called a hollow fiber module below), is filtered by the countless micropore which has opened on the surface of the hollow fiber, and only the clarified water with which SS component, a particle, a contaminant, bacteria, etc. were removed penetrates it inside a hollow fiber, and it is taken out from the filtered water outlet 11 as filtered water. Although the amount of filtered water becomes large so that a raw water pressure is large in filtration of a hollow fiber module, said SS component, a particle, etc. adhere to a film surface with the filtration passage of time, the blinding of a hollow fiber arises to some extent, and, usually the amount of filtered water per same pressure falls gradually. Therefore, when [ suitable ] the blinding of a hollow fiber advances to eye a use \*\*\*\*\* many and the amount of filtered water falls a hollow fiber and a module to it at a long period of time, washing actuation including Ayr scrubbing is performed, and it is necessary even for level near before blinding to recover the amount of filtered water of a hollow fiber.

[0017] In order to perform Ayr scrubbing on the whole film filled up by the container at rear-spring-supporter homogeneity and to raise a cleaning effect, it must stop having to be in the condition which set the membranous filling factor as the suitable range, and also distributed the film in the container at homogeneity.

[0018] When the hollow fiber 10 with which drawing 2 is general module structure and the container 1 was filled up had the high filling factor of a hollow fiber, \*\*\*\* moved also at the time of module manufacture for friction between hollow fibers, and \*\*\*\* was not confused. However, it turned out by Ayr scrubbing's etc. washing a film and carrying out repeat use that plugging by detergency also worsening and carrying out Ayr scrubbing to homogeneity, the dirt which near a raw water entrance sets, and the contaminant will be caused if it is a high filling factor in the module which needs a high life, especially the module which performs all filtration operations and high recovery operation. Although the filling factor of a hollow fiber must be made low for preventing these, if a module manufacture top is a low filling factor, detergency is not only bad, but the module with which the film was turbulence-easy with the module and was done will be distributed by the film to an ununiformity, and appearance will worsen. Manufacture was difficult especially when it was necessary to make homogeneity fill up especially the surroundings of a central tube with a thread.

[0019] this invention persons discover this invention, as a result of examining wholeheartedly the method of fabricating after the film has distributed to homogeneity in a container also in the hollow fiber module of this low filling factor.

[0020] The module fabricated in the condition of having used ready \*\*\*\* by this invention and having made \*\*\*\* penetrating in it does not have film turbulence, either, shaping becomes possible in the condition that \*\*\*\* distributed to homogeneity in the container in the form suitable for the configuration of ready \*\*\*\*, and washing actuation of Ayr scrubbing etc. becomes possible [ carrying out to homogeneity ]. Moreover, ready \*\*\*\* is making it buried into adhesives, and a film does not contact ready \*\*\*\* directly and it does not have a hollow fiber with a blemish, either.

[0021] Thus, it found out that the module which also distributed the low module of a film filling factor to homogeneity in the container could be manufactured by attaching ready \*\*\*\*. Drawing 1 is explanatory drawing of the module which used ready \*\*\*\* of this invention. Quadrissection is distributed by carrying out a hollow fiber 10 around a central tube 4, and adhesives are enclosed and fabricated in the condition of having made ready \*\*\*\* 5 pasted up on the central tube penetrating a hollow fiber. It is what was cut to the location where a hollow fiber carries out the opening only of the single-sided jointing after adhesive setting, and one of the two already attaches the module cap 2 to the outside, closing. It is buried in adhesives and there is an Ayr outlet hole 7 for Ayr scrubbing from the pore opened to the central tube 4, the plug 9 is inserted in the central-tube hole so that Ayr may not fall out in the opposite side, and ready \*\*\*\* 5 has structure which Ayr and raw water do not mix in a filtered water side.

[0022] By the membranous number of partitions, ready \*\*\*\* has a thing various type and showed an example to drawing 3 and drawing 4 . It is important for ready \*\*\*\* in order to carry out penetration maintenance of the hollow fiber bunch, to be processed so that there may be no hollow fiber with a blemish, and there may be no weld flash, and the injection molding article which smoothed the hollow fiber contact section is used.

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[0024] Furthermore, it is most desirable to make it the structure from which prepares the through tube for degassing in the partition portion of ready \*\*\*\*, and Ayr in the adhesives at the time of shaping tends to escape. The diameter phi of 1-5mm has [ the magnitude of a through tube / that what is necessary is just the hole which is the degree from which Ayr escapes ] at best still more preferably good 2-3mmphi. Although it is so good that there are as much as possible many penetration openings, since it divides by the membranous number and the thickness of a portion is restricted, it is effective when 2-3 holes are made in the partition which is usually one. Although setting of a central tube is very easy if the hole for central tubes for penetration of a central tube is made in ready \*\*\*\*, this invention may not necessarily be premised on having a central tube, and may have only the hole 14 which lets a thread pass like drawing 4 , and the hole 14 which lets the through tube 13 for degassing, or a thread pass.

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EXAMPLE

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[Example]

It let one bundle pass at a time to ready \*\*\*\* attached in the location of about 100mm, respectively from the both ends of the central tube with a length of 1110mm with which 24 2mmphi holes opened the hollow fiber bunch which divided 10000 hollow fibers of a polyacrylonitrile with an outer diameter [ example 1 / of 850 micrometers ], and a bore of 350 micrometers into 2500 and four bundles to some pipes. After filling up inside with this at outer-diameter 114mmphi and a transparency outer case with a bore [ phi ] of 100mm and carrying out the seal of the both ends, 250g was supplied so that it might set to a centrifugal molding machine and adhesives might bisect adhesives from nozzle opening of an outer case during rotation, and 500g of adhesives was further thrown in after 30 minutes. One of the two of an outer case was cut 20mm with the chip saw type slicing machine after adhesive setting. Furthermore, the cap was pasted up on outer case both sides, and the module was manufactured. Four bundles of hollow fiber bunches which constitute the manufactured module are completely arranged at homogeneity, and single-yarn turbulence was not observed by each thread. The supply pressure was 0.50kg/cm<sup>2</sup>, when module evaluation equipment was set using this so that 15l. \*\*\*\*\* for /might be obtained in the lake of turbidity 5. Since the film surface became dirty brown when it let water flow directly between 24, when Ayr scrubbing was performed for 5 minutes by part for amount/of 30l. of Ayr, by the time the dirt of a film surface was not different from before exterior water flow, it was recovered. The supply pressure when starting again was 0.50kg/cm<sup>2</sup>.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] The configuration schematic diagram of the module which used ready \*\*\*\* of this invention

[Drawing 2] The outline block diagram of the conventional module

[Drawing 3] An example of ready \*\*\*\* which has the hole of a central tube

[Drawing 4] An example of ready \*\*\*\* which does not have the hole of a central tube

[Description of Notations]

- 1: Outer case (container)
  - 2: Module cap
  - 3: Nozzle
  - 4: Central tube
  - 5: Ready \*\*\*\*
  - 6: Encapsulant (adhesives)
  - 7: Ayr Ko Deguchi
  - 8: Ayr feed hopper
  - 9: Plug
  - 10: Hollow fiber
  - 11: Filtered water outlet
  - 12: Degassing hole
  - 13: Central-tube catching hole
  - 14: Hollow fiber through hole
- 

[Translation done.]

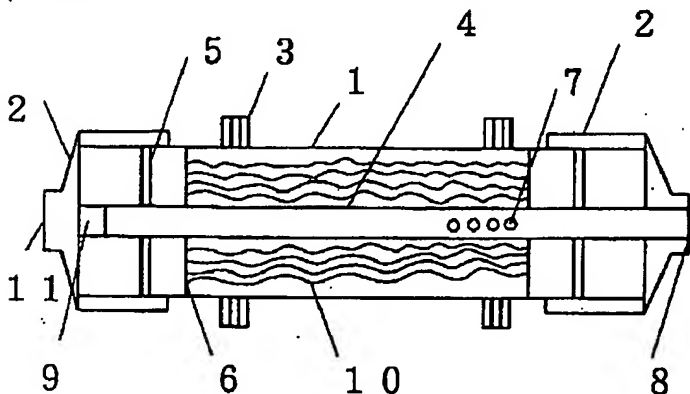
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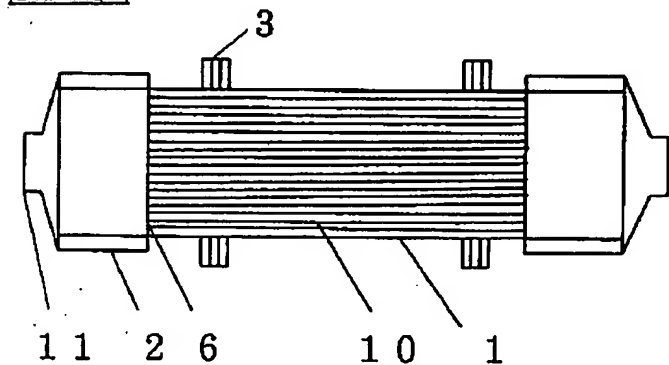
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DRAWINGS

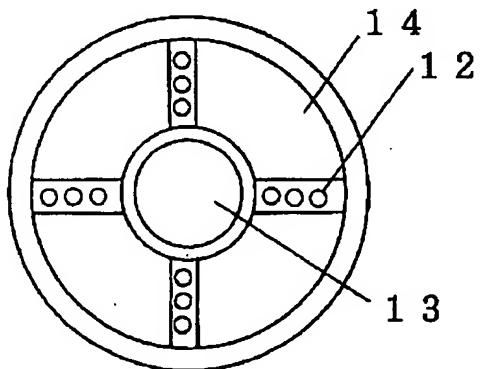
[Drawing 1]



[Drawing 2]

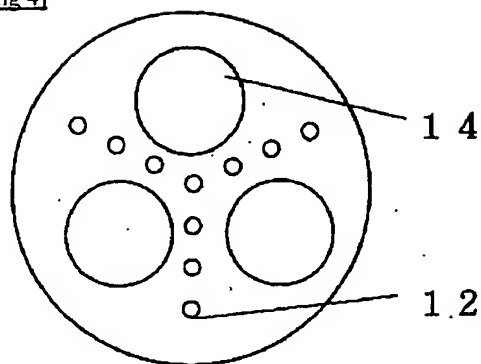


[Drawing 3]





[Drawing 4]



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